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USAF Joint Expeditionary Force Experiments Experiment Management Lessons Learned

Submitted by

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Abstract

This paper presents observations and insights from experiment senior mentors, warfighters, and experiment management personnel from five Joint Expeditionary Force Experiments (JEFX). The design, planning, execution, and assessment of a large-scale command and control experiment are addressed. In addition, experiment management changes for JEFX 06 are presented.

USAF Joint Expeditionary Force Experiments Experiment Management Lessons Learned

Background

Joint Expeditionary Force Experiment is a large-scale Air Force experiment designed to assist the U.S. Air Force in preparing for the challenges of the 21st Century Expeditionary Air and Space Force operations. To that end, the experiment is an operational innovation activity that attempts to anticipate and model a future command and control (C2) system. JEFX 04 was the fifth in the series that began in 1998.

JEFX consists of three spiral events followed by main execution with approximately 5,000 warfighters, engineers, analysts, communicators, and public affairs participants. Experiment concepts and initiatives are selected based on their potential to solve Air Force capability shortfalls. JEFX 04 included sites across the United States as shown in Figure 1. The majority of player activities, including Live-fly, are performed at Nellis AFB, NV. Modeling and Simulation support is provided from Hurlbert AFB, FL.

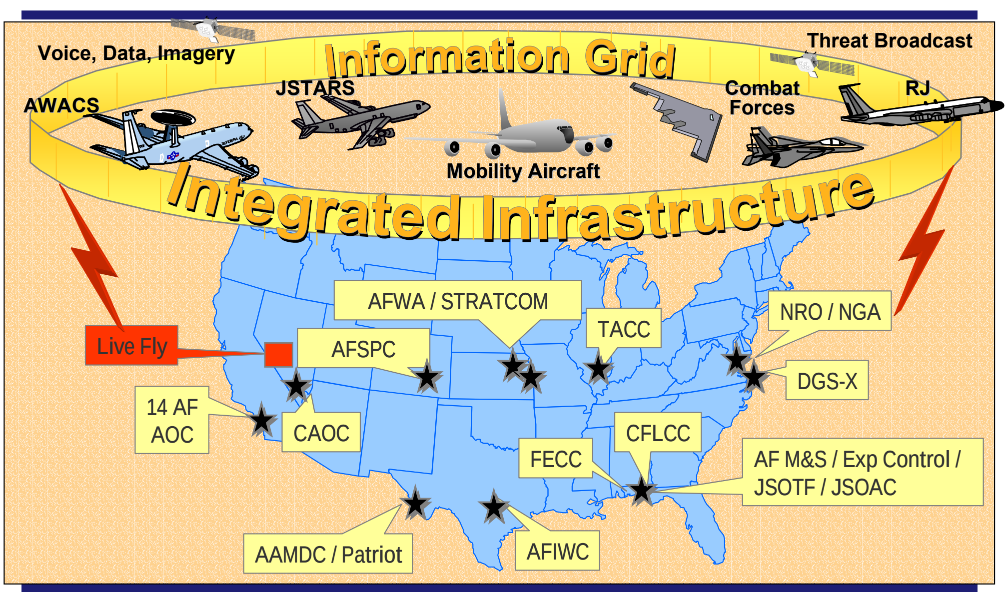

Figure 1—JEFX 04 Participating Sites

During each experiment, data is collected from experiment participants on ways to improve the management of the experiment itself. Observations and surveys are collected via a web-based tool from senior mentors, players, assessors, and support personnel during each experiment on ways to improve the design, planning, execution, and assessment of JEFX.

Design

The guidance and support of Air Force senior leadership is instrumental to the success of JEFX. The Chief of Staff of the Air Force (CSAF) has traditionally provided the guidance needed early

in the design phase to scope the experiment. AF senior-leader funding support has allowed designers to adequately model a future command and control system as well as allowing successful transition of initiatives. JEFXs have shown that during the initial design stage, CSAF guidance must be sought out prior to any major design decisions such as the exclusion of coalition participants.

The CSAF has directed some experiment management changes over the years such as the direction to focus the experiment on near-term capabilities with a goal of 85 percent of initiatives being near-term (i.e., transitionable 6-24 months following the experiment) and 15 percent of the experiment focused on long-term concept development. CSAF reduced the scope of the experiment by limiting the number of initiatives to 10 or fewer, based on the attempt in JEFX 00, to execute and assess 45 initiatives. Operating with so many variables was difficult and follow-on transition was not achieved to the extent desired.

Developing a method to transition successful initiatives before the experiment begins is a key lesson learned. JEFX began programming 10 to 20 percent of the experimentation budget for transition of successful initiatives to encourage healthy initiative submission as well as to speed the fielding of capabilities sooner than traditional acquisition approaches. The Air Force Experimentation Office (AFEO) learned that the transition funding must lead to long-term sustainment funding. The initiative selection criteria were changed to require that each initiative have a sponsor. A sponsor was defined as an organization with Program Objective Memorandum (POM) authority that would commit to long-term sustainment funding if the initiative was recommended for transition. Sponsors also became responsible for developing a transition plan following the experiment. A Transition Branch was formed at AFEO to handle the transition of successful initiatives coming out of experimentation. Figure 2 shows the metrics the Transition Branch developed to report the status of initiative transition to the AF/XI.

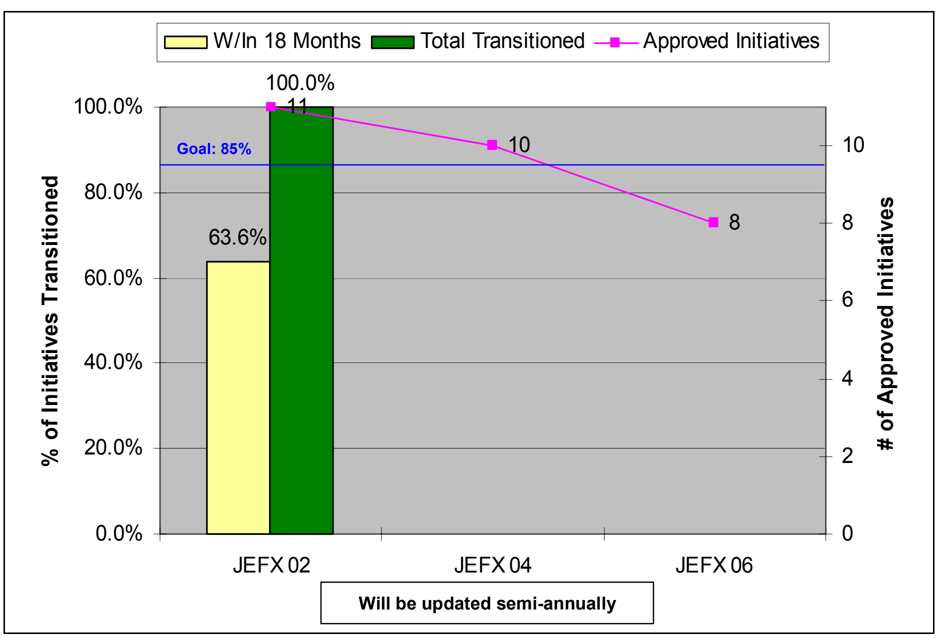

Figure 2—JEFX Initiative Transition Metrics

The Five-year Experimentation Campaign Plan has been beneficial. It has improved experimentation by defining the long-term schedule and resource requirements. AFEO has

learned that large-scale field C2 experiments require 20 months to plan and execute and that experiments involving coalition participants can require even longer. This determination has lead to a two year cycle for JEFX experiments. Figure 3 shows the draft schedule for JEFX 06.

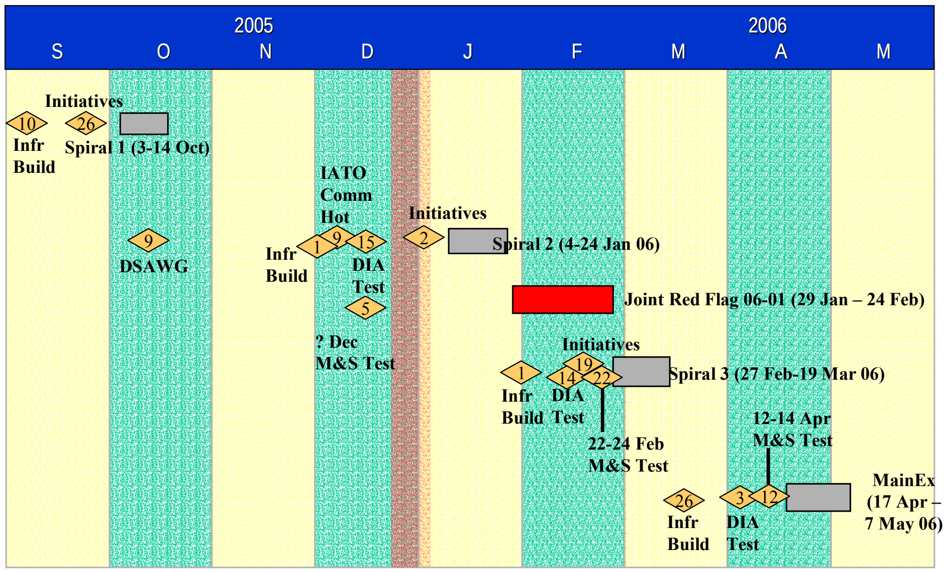

Figure 3—JEFX 06 Draft Schedule

A small-scale (1 /20th the size of JEFX) Advanced Process and Technology Experiments (APTX) has been executed twice in intervening years and has provided a more continuous experimentation methodology. Currently, APTX Execution is envisioned as the Spiral 0 for future JEFX events, to provide better linkage between experiments. Previous JEFX lessons are that experiment recommendations must be available in time for immediate POM cycle submission and that experiment execution must be deconflicted from the summer months. These two lessons have led to a planned experiment execution schedule of Oct to May for JEFX 06. A three-spiral schedule followed by main execution with a minimum of 6 weeks between spirals to allows time for innovation to occur between the spiral events.

The campaign plan has been more effective when senior leadership has directed long-term, recurring focus on specific areas of interest such as the multi-experiment Time Sensitive Targeting (TST) effort conducted between 1999 and 2004, which resulted in tremendous C2 advances. These advances were used in Operation IRAQI FREEDOM. Recent JEFX experiment results have drawn attention to areas such as Effects-Based Operations, which will require a long-term service and joint effort—as happened with TST—if senior leadership decides improvement is needed. Campaign plans will be also be useful for pre-identified long-term efforts such as Net-Centric Warfare. Past lessons indicate a 5 to 8 year period is needed with both service and joint large-scale field experimentation in order to achieve significant results.

Experimentation campaign plans lead to experiment results that influence higher level capability-based planning. An example is the newly developed AF Transformation Flight Plan, which, in turn, influences future experimentation campaign plans. JEFX results also influence AF capability-based planning by providing experiment results to support the draft Capability Review and Risk Assessment activities and CONOPS development efforts, as shown in Figure 4.

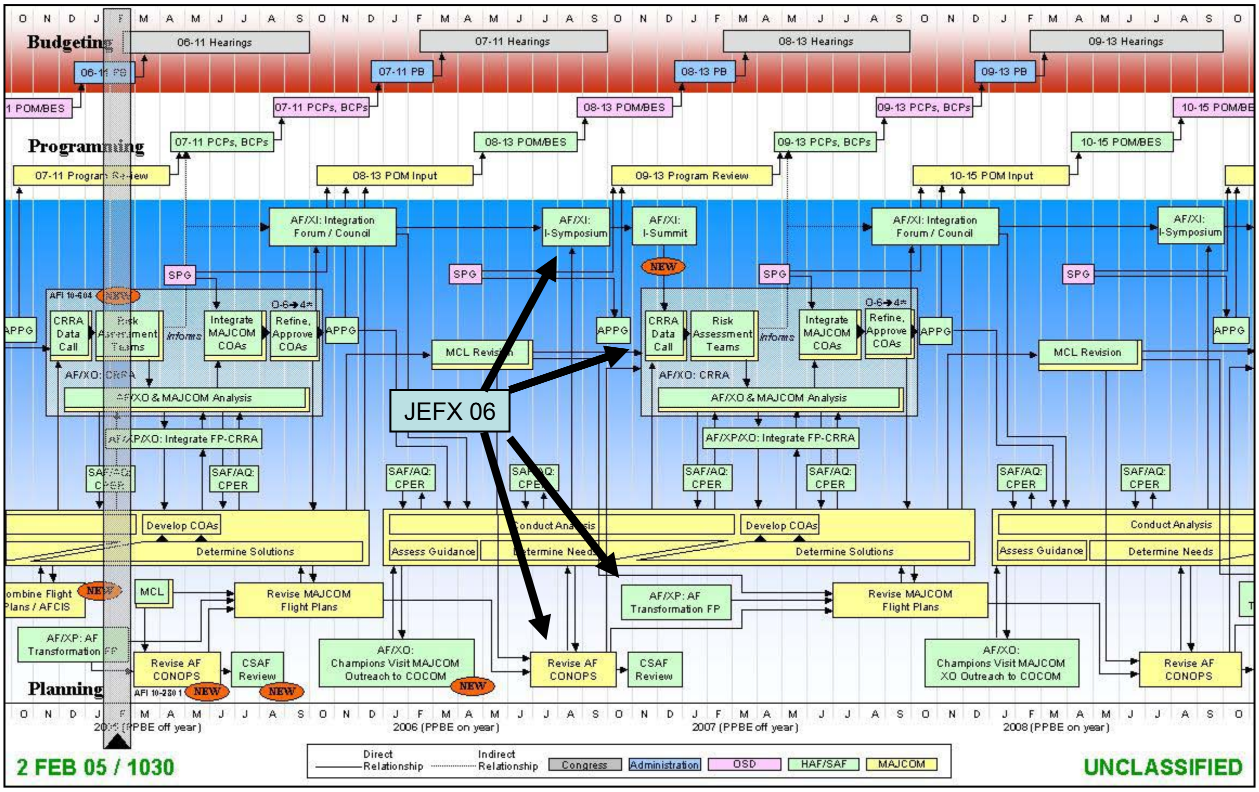

Figure 4—JEFX 06 Potential Linkages to Draft AF Capabilities Based Planning

The use of operational threads as a framework for the design of an experiment has been useful. During JEFX 04, the Army Close Air Support Situational Awareness (ACASSA) initiative began designing operational threads for their experimental processes. In parallel, the assessment team began identifying operational threads as a way to demonstrate operational relevance for initiative capabilities. A thread is a series of linked tasks that provide the framework for measuring an overall capability in an operationally relevant context. This logical next step resulted from previous assessments that analyzed TST capability by assessing the more measurable Find, Fix, Track, Target, Engage, and Assess tasks. It was learned that operational threads must to be designed into the experiment so that the scenario and Master Scenario Events List (MSEL) will support the assessment and so that the threads themselves are deconflicted and executed as designed. Using operational threads as a design technique increased the use of architectural Operational View and Technical View products such as those shown in Figure 5. This technique resulted in increased rigor of the experiment design. Detailed "scripts" were built for the threads that documented inputs, controls, systems, activities, and outputs.

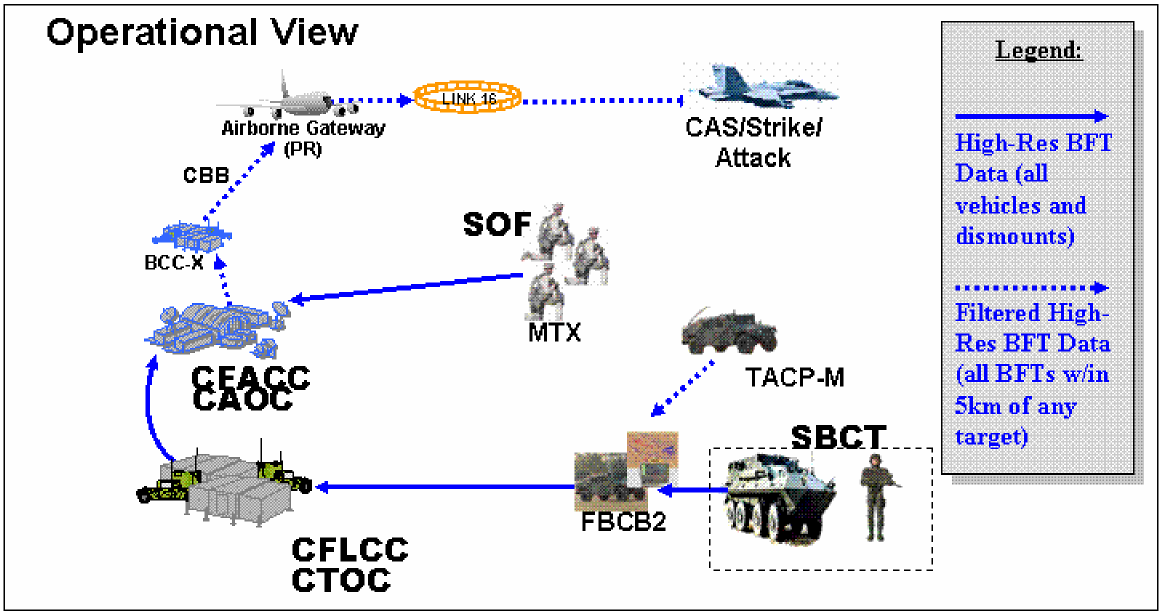

Figure 5—JEFX 04 ACASSA Operational View

Live experimentation events or “Live-Fly,” in JEFX vernacular, provide the end-to-end test needed to assess operational utility. Many initiatives require Live-Fly to demonstrate capabilities. Live-Fly has also been useful to validate that operational level processes will support tactical level execution. Constructive and virtual simulation can and do provide the experiment environment at a lower cost and are used to train participants and to spiral-develop processes and systems. It is difficult to innovate when Live-Fly is a one-time, short, exercise-like event. Therefore, Live-Fly duration was increased from 5 to 9 days in JEFX 04 with more time to innovate between missions. It was also learned to limit participation to the minimum number of live-fly players needed, with greater participation of test squadrons. It has been difficult for experiment designers to make the transition from the constructive phase (supported by modeling and simulation) to the Live-Fly phase transparent to the experiment players. A 10-mile buffer around the ranges has been used to separate constructive entities and live-fly aircraft on the Common Operational Picture for safety-of-flight reasons. The constructive scenario and MSEL events must be aligned with the Nellis range configuration and events to improve the situation. Increased use of virtual platforms during the constructive phase may also improve the transition.

Combining large-scale field experimentation with a large joint exercise is not a complementary mix. Conflicting objectives and battle rhythms impede innovation, confuse the participants and controllers, and can result in negative learning. The objective of an *experiment* is to learn and discover, but an *exercise* is designed to practice what already is known. Warfighters have stated their surprise when they find experimentation to be much more difficult than participating in an exercise. Warfighters also come to realize experimentation is not about winning the war or evaluating their performance. Joint participation has shown to be very beneficial when each Service’s experiment objectives are compatible. Joint operations reveal the seams between Services’ C2 and leads to joint and service Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) recommendations for change.

However, combining testing and experimentation is compatible to some degree. Smaller scale testing within an experiment has proven very easy to integrate within the existing control and

battle rhythm construct of an experiment. Early spiral events are focused on technical assessment and are very similar to tests. The live-fly venue, however, has many uncontrolled variables and inadequate instrumentation. To date, it has not provided the environment needed to conduct rigorous testing.

The initiative selection process is never over. Senior leadership can override early decisions, and late initiatives have become a routine part of every experiment, requiring revisions to architectures, floor plans, and other elements of the experiment. The lesson learned here is to be flexible and build in room for growth in an experiment. This room for growth must include budget, schedule, and space. There is a point of diminishing returns however. In JEFX this point occurs at Spiral 2. After Spiral 2, new initiatives are not usually integrated well into the experiment and often end up as stand-alone demonstrations.

Planning

Augmenting existing organizations with permanent experimentation billets has shown to be a valid organizational construct. The JEFX organization is the Experimentation Enterprise. This enterprise consists of existing AF organizations that have been augmented with permanent staff to work JEFX tasks. The JEFX Experiment Enterprise consists of Electronic Systems Command at Hanscom AFB, 505th Command and Control Wing at Hurlburt AFB, and the AFC2ISRC and ACC/SC at Langley AFB. Augmenting existing organizations rather than forming a large experimentation organization allows significant organizational flexibility. Experimentation work is often shifted to other staff when required. The organizations with permanent staff funded by experimentation have become known as the “4-ship.” The Air Force Experimentation Office, as part of the AFC2ISRC, is the flight lead, and the other members have distinct roles and responsibilities. The 4-ship provides JEFX an in-place collaborative team that crosses many “tribal” lines and provides JEFX the ability to quickly tap into a wealth of expertise to get things done.

A method is needed to document, update, and track manning by function, software, and hardware requirements and configuration. An Operator, Position, System, Application, Training and Hardware (OPSATH) document has been used to plan hardware and software configurations for individual participants and to help in the development of individual profiles and passwords. The OPSATH is a Microsoft Excel™ spreadsheet populated with all experiment manning positions and all the software options. This information has been shared via periodic publishing, but due to the dynamic reconfiguration required during an experiment, it has always served as a planning document rather than a configuration control document. It has been proposed that the Excel spreadsheet become part of an online database on the JEFXLINK Website so that it can be accessed real-time from any location and thereby usable as a configuration management tool during execution.

A web portal is essential to share and manage information across the experiment enterprise efficiently. The JEFXLINK Website shown in Figure 6 has been instrumental to the sharing of planning and execution information.

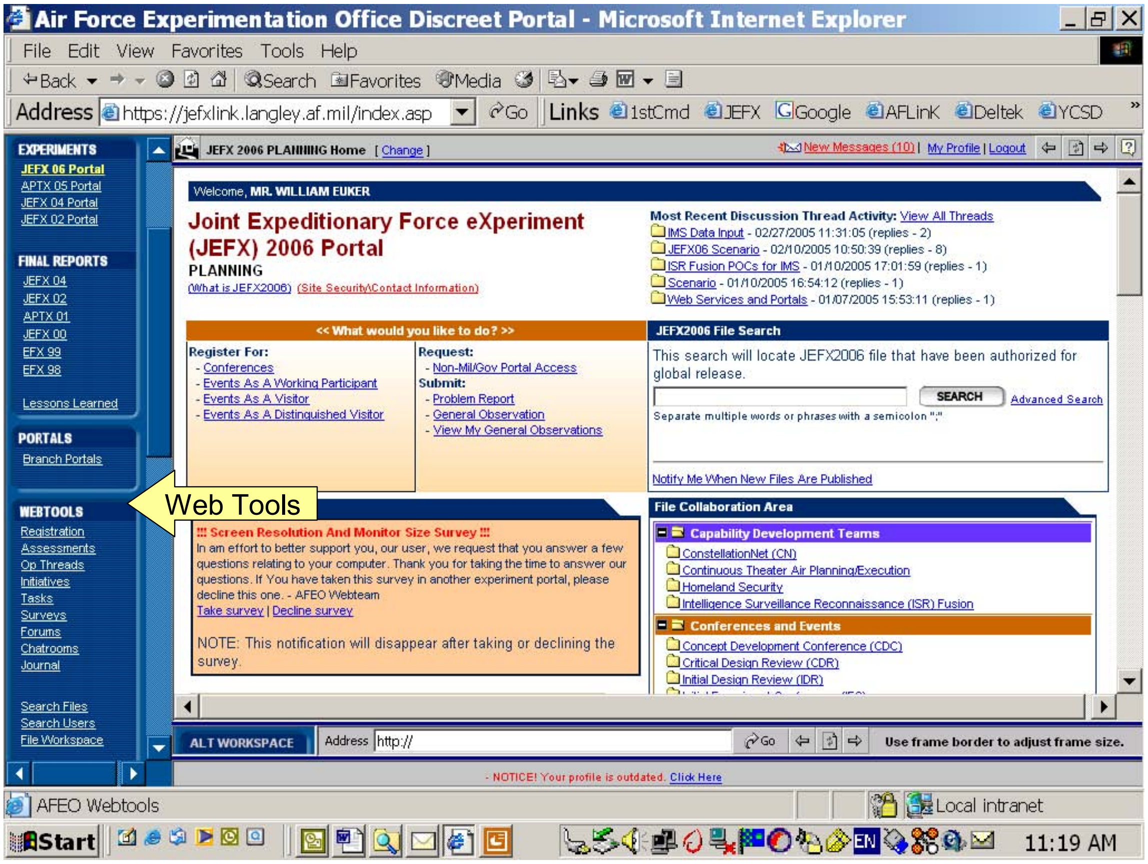

Figure 6—JEFXLINK Website

JEFXLINK provides a virtual workspace to immediately share information across this enterprise. In addition "web tools" were added to help manage manning and assessment tasks and to encourage collaboration. A small team of AFEO-dedicated web developers has identified unique experiment requirements and added functionality over a 6-year period. Having dedicated web-tool developers rather than a "pick-up" team each experiment has proven to be a key management decision. Event registration, participant profile information, Deployment Requirements Manning Document (DRMD) development, surveys, web forums, web chat, private journals, document collaboration, a calendar, and a problem reporting system are now being accessed online on NIPRNET, SIPRNET and—during JEFX 04—on a Coalition-NET. Additional functionality is being added so that operational threads can be built and accessed online and so that DRMD and OPSATH databases are built online with linked databases.

The integration of Coalition members into an experiment requires additional effort, planning time, and senior leader support. Figures 7 and 8 show the DOD Information Technology Security Certification & Accreditation Process (DITSCAP) and data disclosure steps and timelines executed during JEFX 04.

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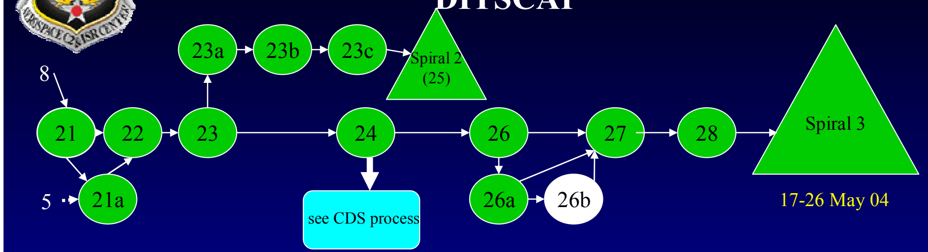
Critical Path to Spiral 3

DITSCAP



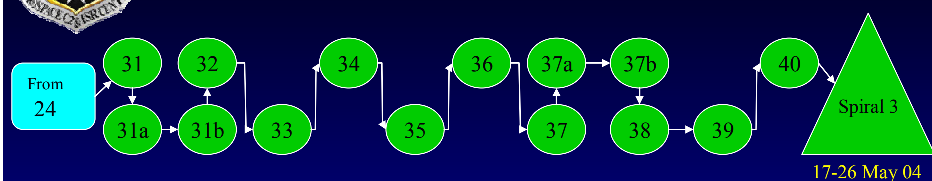
21	17 Oct 03	17 Oct 03	ACC/SCW	Complete DISA Form 41 and submit to DISA SCAO
21a	24 Oct 03	24 Oct 03	DISA SCAO	Assign interconnect number
22	7 Nov 03	18 Nov 03	ESC/CXE & ACC/SCW	DAA signs GRA & transmits to DISA SCAO
23	22 Dec 03	16 Jan 04	ACC/SCS/SCW & ESC/CXE	DAA signs IATO letter & transmits w/support docs to DISA SCAO:
23a	1 Mar 04	20 Feb 04	DISA SCAO	IATC documentation/approval for Spiral 2
23b	15 Mar 04	1 Apr 04	ESC/CXE & ACC/SCW	Comm-hot circuits for testing for Spiral 2
23c	19 Mar 04	19 Mar 04	AFC2TIG, Army, ACC DAA	Sign M&S DAA letters (AF & Army) for Spiral 2
24	24 Mar 04	17 Mar 04	ACC/SCS/SCW & ESC/CXE	CDTAB meets to review CDS package
25	29 Mar 04	29 Mar 04	AFC2TIG	Conduct Spiral 2 (29 Mar-7 Apr 04)
26	13 Apr 04	13 Apr 04	AFEO & ESC/CXE	DSAWG decision on CDS
26a	20 Apr 04	19 Apr 04	AFEO & ESC/CXE	If necessary, appeal to Flag Panel
26b	27 Apr 04	n/a	AFEO & ESC/CXE	If necessary, appeal to DISN DAA
27	30 Apr 04	26 Apr 04	DISA SCAO	Provides approval to connect NIPRNET/SIPRNET (IATC for Spiral 3)
28	1 May 04	12 May 04	ACC/SCW	Comm-hot circuits for testing

Red	Stopped	Yellow	In Progress	White	Pending	Green	Complete

p. 4

Critical Path to Spiral 3

DITSCAP-CDS Process (cont)



31	1 Oct 03	17 Oct 03	ACC/SCW	Submit information for CDS ticket assignment
31a	6 Oct 03	6 Jan 04	AFEO	Obtain COCOM endorsement
31b	7 Oct 03	11 Feb 04	JCS J6	CDS ticket numbers assigned
32	1 Oct 03	9 Dec 03	ESC/CXE	Identify all systems and software used on the coalition LAN or any system or software accessible by coalition participants in the coalition enclave
33	15 Oct 03	30 Jan 04	ESC/CXE & ACC/SCW	Submit technical documentation for each guard implementation (SSAA documentation & CD Appendix) Required NLT 13 Feb 04
34	12 Nov 03	12 Nov 03	AFEO, ESC/CXE	Conduct informal briefing to DSAWG
35	9 Jan 04	9 Jan 04	AFEO	Submit JEFX 04 Plan, EPO, to DISA SCAO
36	10 Feb 04	10 Feb 04	DSAWG	Community Jury (DSAWG) tasks NSA to work CDS
37	13 Feb 04	13 Feb 04	ACC/SC	Submit CD Appendix w/SSAA to DISA SCAO
37a	8 Mar 04	8 Mar 04	ESC/CXE	Update SSAA documents for Spiral 3
37b	19 Mar 04	19 Mar 04	Strategic Sites	Strategic site accreditation packages due to ACC/SC for Spiral 3
38	24 Mar 04	17 Mar 04	CDTAB	CDTAB/CDSAP meet to assess JEFX CDS proposals
39	13 Apr 04	13 Apr 04	AFEO & ESC/CXE	DSAWG Decision Brief
40	1 May 04	26 Apr 04	AFEO, ESC/CXE	Obtain IATC approval thru DSAWG for Spiral 3

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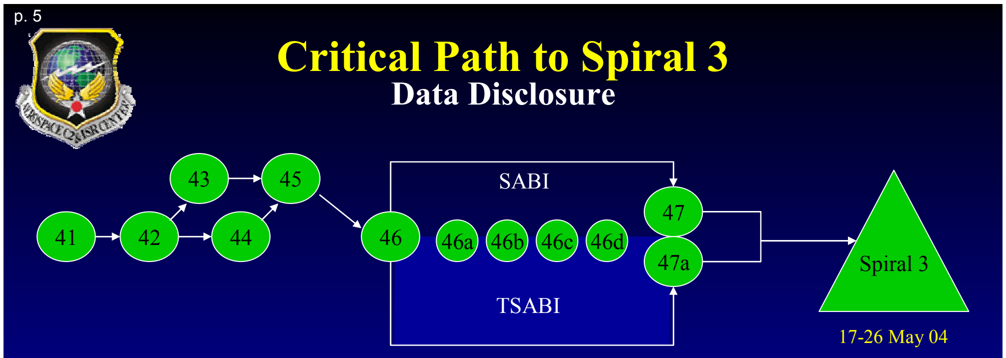
Figure 7—DITSCAP Timeline



41	30 Sep 03	1 Oct 03	AFC2TIG, ESC/CXE	Identify data needed for coalition operations
42	30 Sep 03	15 Oct 03	AFC2TIG, ESC/CXE, AFC2IS	Identify data owners & obtain data disclosure approval from release authorities
43	15 Oct 03	15 Oct 03	SAF/IAPD, AFEO	Submit data disclosure request to SAF/IA
44	15 Oct 03	15 Oct 03	ESC/CXE	Compose data flows
45	31 Oct 03	31 Oct 03	SAF/IAPD	Determine export licensing
46	31 Oct 03	25 Feb 04	SAF/IAPD & 8 AF	Make revisions to exchange officer PDs & DDL
46a	21 Nov 03	13 Jan 04	SAF/IAPD	Compose Delegation of Disclosure Authority Letters (DDL)
46b	31 Jan 04	31 Jan 04	ESC/CXE	Compose data owner guidance
46c	20 Feb 04	25 Feb 04	CFACC	Obtain data owner guidance appoval
46d	29 Mar 04	29 Mar 04	ESC/CXE	Program RM guards with rule sets
47	1 Mar 04	13 Jan 04	SAF/IAPD	DDLs approved for SABI process
47a	1 Mar 04	1 Mar 04	SAF/IAPD & 8 AF	Review DDLs/documents for coalition reps w/SCIF duties if necessary

Red	Stopped	Yellow	In Progress	White	Pending	Green	Complete

Figure 8—Data Disclosure Timeline

Because of their need to support ongoing real world activities, it can be difficult to obtain the support of policy and technical groups to review and approve experimentation architectures and to develop release policies. Experimentation needs senior leader support or experimentation must be elevated in importance or the steps in this process cannot be completed in 8 months, as was needed for JEFX 04. In JEFX 04, AF obtained the support of the Chairmen of the JCS in order to achieve the experimentation timeline. Experimentation architectures cannot be developed earlier than 8 months ahead of time, because initiatives and supporting infrastructure are being defined and engineering innovation is occurring as the experiment design is being developed.

Execution

A professional control force is important to execution success. Their subject matter expertise on scenario, Master Scenario Events List (MSEL) and modeling and simulation makes the experiment run. A mutually supportive relationship must exist between assessment and control teams. Each team depends on the other for feedback to achieve experiment objectives. The use of the Joint MSEL program by assessors and controllers to collaborate dynamically was shown to be a very useful capability in JEFX 04. The program must be modified, however, so that the taxonomy of an experiment is supported; for example, operational threads and initiative capabilities rather than training objectives.

Senior mentor participation in experimentation promotes sharing lessons and resolving issues. Most senior mentors are involved with other joint and service experiments and wargames. Their participation in other experimentation venues helps share lessons across the joint force and promotes resolving problems at the general-officer level if needed. The execution team, the

assessment team, and the Joint Force Air Component Commander have been assigned dedicated mentors in past experiments and these senior mentors have been proven to be useful.

The spiral development and assessment process shown in Figure 9 has been a very successful approach to developing capabilities. It is essentially a building-block approach to construction of a future C2 architecture. A minimum of 6 weeks is needed to allow innovation to occur between spirals and to allow issues to be identified and addressed before the next event. The assessment activities become more focused on operational utility as the warfighters become trained and proficient, the architecture is completely connected and stabilized, and technical assessment is completed.

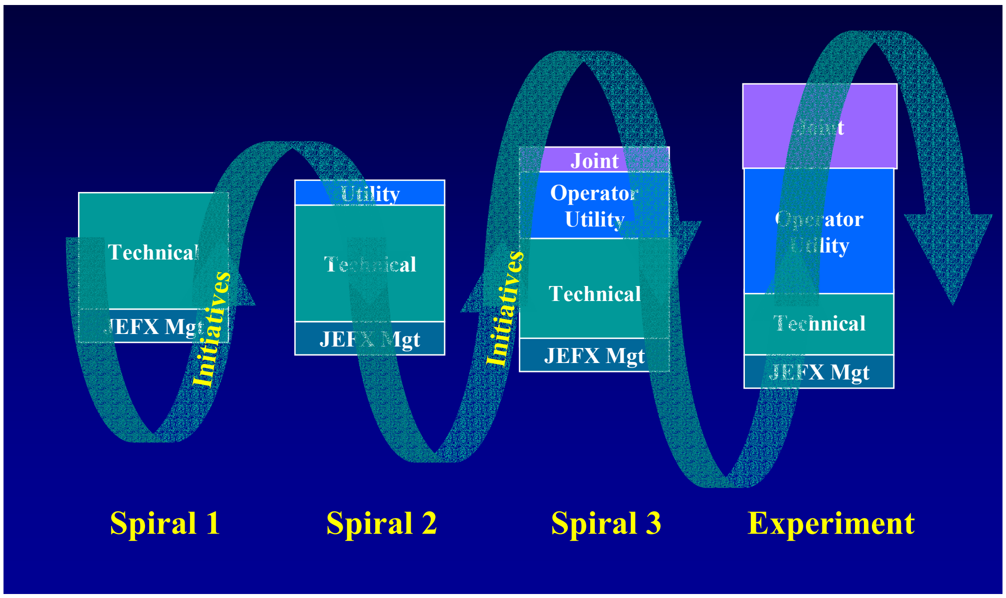


Figure 9—Spiral Development/Assessment

A permanent infrastructure increases the stability and, therefore, the ability to demonstrate capabilities in an experiment. The building of the Combined Air Operations Center–Nellis (CAOC-N) built in 2003 and shown in Figure 10 provided a permanent infrastructure to JEFX to maintain the architecture between spirals.

Figure 10—Combined Air Operations Center- Nellis

In previous experiments, trailers were used and systems were dismantled between spirals. This approach was costly and impeded the development of a stable architecture. It is envisioned that placing this facility at a tactical training base can provide better integration of the operational level (e.g., producing strategy and Air Tasking Orders) and tactical level of war (e.g., creating effects by dropping bombs).

The ability to maintain configuration control of the architecture while encouraging innovation is a challenge. By nature, innovation requires daily tinkering with systems configuration. Having a stable and documented configuration requires some management of this change process. Rules of Engagement must be established for contractors and initiative providers in order to control changes. The challenge is to allow rapid, dynamic changes while still maintaining a stable and documented architecture.

Maintaining player team continuity during an experiment is required. Weeks of training is conducted prior to main execution to provide the participants the best understanding and ability to use new initiatives. Having players leave after one or two spirals reduces the ability of the warfighters as a group to execute the new processes with new systems. Turnover has been minimized in experiments by soliciting strong senior leadership participation early in the experiment planning stages and requiring all manning changes be vetted through them during execution. Another major change that reduced manning turnover was the establishment of a lead Number Air Force as the "core NAF" for each experiment, rather than manning the experiment with a "rainbow NAF" approach. The establishment of a dedicated "experimentation NAF" is being explored with 8th AF returning for the second experiment in a row. The hope is that some corporate knowledge will return with the same NAF. Warfighters recognized the differences between experimentation and exercises after the first experiment and now should be more prepared to achieve experimentation objectives in the future.

The continuity of experiment enterprise manning has reduced repeat lessons learned and permitted a steady development of experimentation knowledge. Experiment designers, engineers, controllers, and assessors have been a lead group of civilian contractors who have—over a series of experiments—developed a body of knowledge on how to design and execute large-scale field

C2 experiments. The experimentation community has had a healthy turnover but has also retained many contractors from experiment to experiment who have built up the corporate knowledge level. Corporate knowledge is documented on JEFXLINK Website in the artifacts and reports of each experiment.

Tension occurs between “experimenting to learn” and “experimentation to field.” JEFX has always been part discovery/experiment, part hypothesis-testing, and part demonstration. The pendulum in recent experiments has swung more toward experimentation to field and is expected in the future to move beyond just demonstrating to testing before fielding. The commingling of these different types of experiments is not without issues. Initiatives may not be properly demonstrated if significant infrastructure innovation is occurring during discovery experimentation. Balancing these different types of experiments has required temporal separation, which is usually accomplished by conducting most innovation during or between spiral events and reserving the main execution for the official demonstration phase. This approach has worked well with technical assessments. During the first part of each spiral, the technical assessment activities are scheduled as separate from the player activities, if possible. But in every experiment, so many changes and activities are occurring daily that the saying is, “if you think you know what’s going on, you obviously don’t know what’s going on.” This situation leads many participants to feel constantly off-balance and unprepared for execution; not knowing exactly how things will work day to day.

Assessment

Determining ground truth in live experiments is difficult. Because of the scope and dynamic nature of JEFX experiments, it is difficult to control all the variables, especially in live-fly activities. The live-fly experiment is just one of many events on the range each day and live-fly systems are not all instrumented as they would be for a test event. A balance must exist here. Instrumentation costs money and buying up all the systems’ time on the range for a period of time can be cost-prohibitive. However, flexibility is needed in experimentation because play can be dynamic and the need for data on one particular target or threat is not always predetermined. The lesson learned here is to reduce the time and range area needed for ground truth ahead of time, buy only what is needed, and articulate not only what must happen to support the experiment but also what activities on the range must *not* occur. A range liaison to the assessment team would help avoid many of these problems.

Warfighters in the experiment contribute to the assessment of process and system initiatives. They are not evaluated for their performance but are in the experiment to provide the assessment team a warfighter’s perspective on the value of an initiative—a subjective assessment of the initiative. Objectives measures are collected by the assessment team to augment this subjective assessment as well as objective technical assessment of initiative performance. It usually takes warfighters some time before they realize “winning the war” is not the focus of experimentation and that their individual performance is not being assessed except in terms of their expertise to provide valid assessment.

The technique of determining what issues must be addressed in the final report first and then building a team around the report has proven to be a successful approach. In other words, build your assessment team from the final report back. The Assessment Plan and support team is unique for each experiment. Depending on the focus of the experiment, operational and technical assessment subject matter experts are chosen to assess the demonstration of capabilities. These assessors must be independent of the initiative and must have the understanding of both the

process and programming that this capability is proposed to transition into. A core staff that returns to each experiment and that is augmented by experts covering DOTMLPF categories has been a useful approach, since JEFX reports to date have required recommendations for these categories. Addressing senior leadership issues and questions during the planning phase and updating the categories of the report as senior mentors determine new issues during execution is key to being on target with the final results.

Automation must be developed to quickly determine C2 process results. Because C2 weapon systems have not been designed with an intrinsic debrief capability, the manual collection of data is often required. Data from several system and operator locations must be recorded by assessors and analyzed as a group to determine actual results. This analysis is a very manpower-intensive and time-consuming process. Automatic collection of data across several systems and production of measured results of the activities are needed at the end of each day. Some improvement has been made with the use of the Modular Analysis and Test Support System (MAnTSS) shown in Figure 11 in JEFX 04 to collect real-time, live-fly data and compile an operational thread result. However, only one or two threads were reconstructed per day. Also, MAnTSS was not connected to the coalition network and systems; therefore it did not collect all of the required information. Due to a lack of information and time, a live-fly debrief was never available for more than 6 of the 30 or more CAOC taskings that occurred in the average 4-hour range period. A better C2 debrief capability is needed for JEFX experimentation.

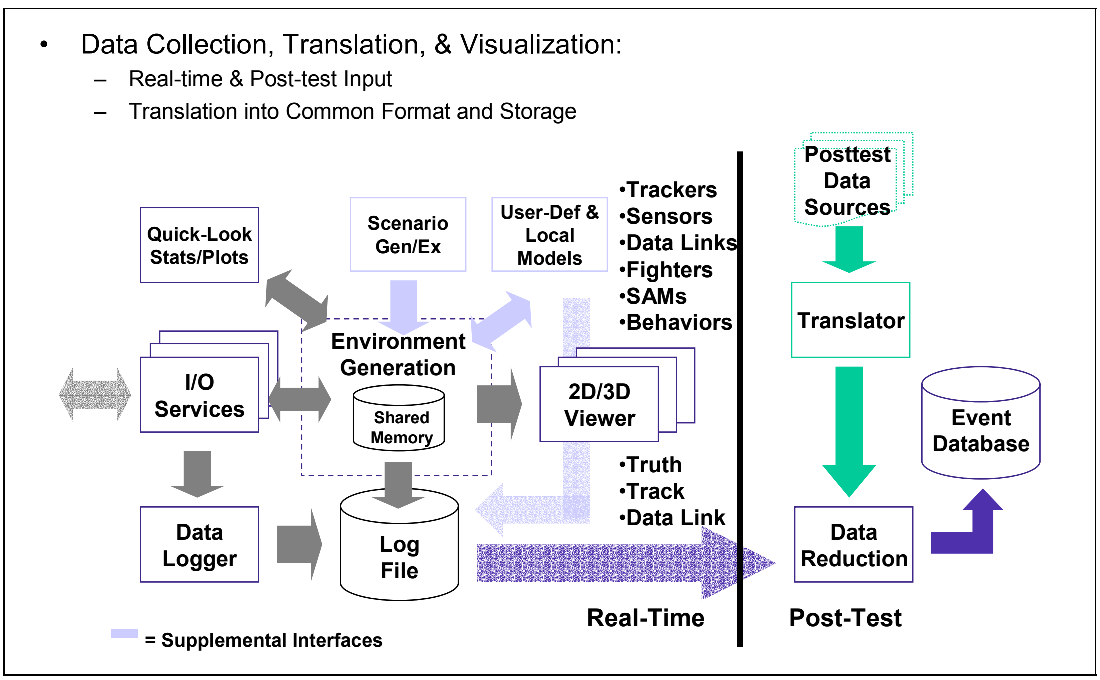


Figure 11—MAnTSS Data Flows

In order to quickly collect the data for 30 or more CAOC taskings, an automated data collection capability is needed on the CAOC network so that data collectors' observed results and system information can be stored in one event database. If all C2 tasking information is logged and data can be analyzed from any workstation by the assessment team, then automated reports can be generated to provide an acceptable 80-percent solution of results before debriefs begin.

Way Ahead

A conscious management decision has been made to take increased risk in JEFX 06, based the advice in *Power to the Edge* and *Campaigns of Experimentation: Pathways to Innovation and Transformation.* The main engine of the Air and Space Operations Center (AOC) system-of-systems will be upgraded with Theater Battle Operations Netcentric Environment (TBONE). This revolutionary change will affect several areas of DOTMLPF for the AOC and is intended to improve network-centric attributes of the AOC. The *Network Centric Operations Conceptual Framework version 2.0* may provide a framework for development of measures and the reporting of results.

The experimentation management organizational structure has also changed to one built around Capability Development Teams (CDT). These AFC2ISRC lead cross-matrixed teams will build operational threads to focus experimentation on steps designed to achieve capability goals. CDTs will use the operational thread construct to design into the experiment the tasks, supporting systems, personnel, and MSELs needed to demonstrate a capability. The JEFXLINK operational thread web tool shown in Figure 12 is being used to document the threads online in order to standardize the thread constructs as well as to provide a virtual collaboration workspace. The assessment team plans to build the measures into the tasks so that results can be populated online to provide easy roll-up of results.

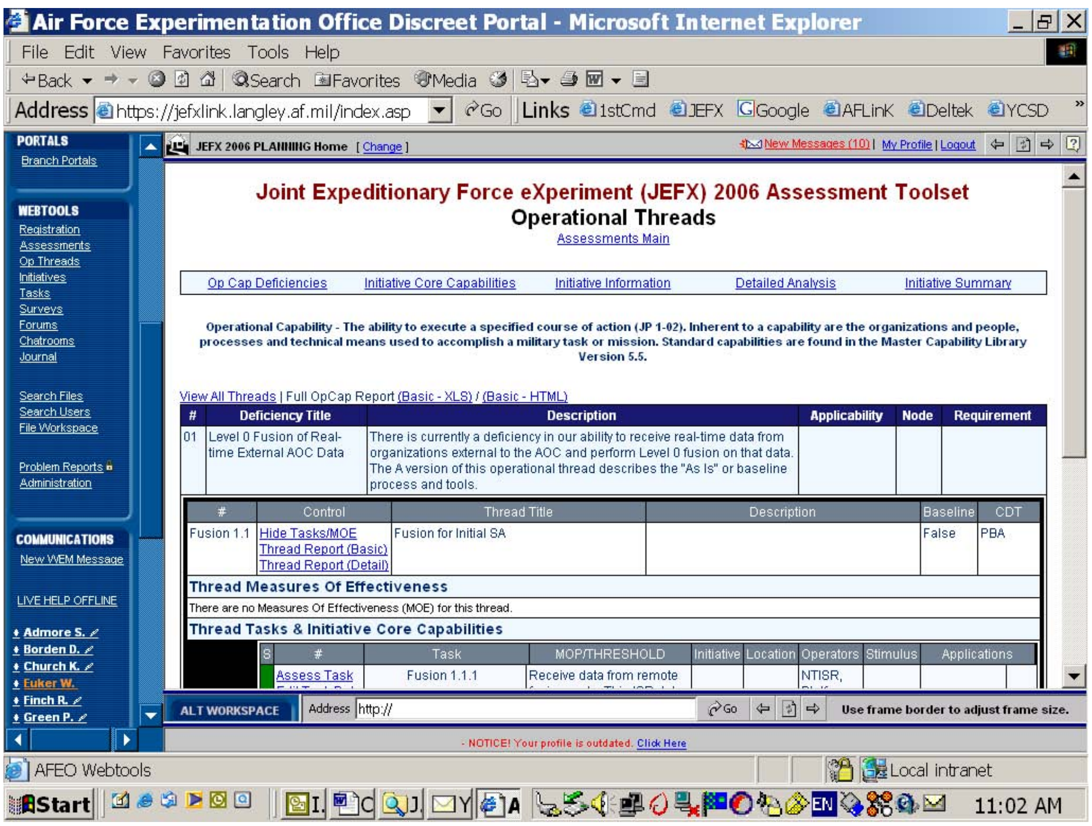


Figure 12—Web-Based Operational Thread Development

The spiral development of live-fly activities will occur by conducting Live Fly during both Spiral 3 and Main Execution to permit time for innovation to occur after Spiral 3 as lessons are

learned about building, controlling, and using an airborne IP network. Past JEFXs have demonstrated that establishing a stable Link-16 environment was an almost insurmountable challenge and the adoption of the spiral development process to live-fly architectures was long overdue.

Distributed Operations has been a focus of JEFX in the past, but was not adequately supported by system capabilities and communications. Currently, an increased focus on Force Level and Unit Level collaboration using TBONE is planned for JEFX 06. It is proposed that four Wing Operations Centers be modeled to replicate bomber, fighter, and Navy units. The desire is to reduce the unit manning in the AOC, provide units more lead time in planning, and improve the effectiveness of the assessment of effects.

Finally, the extent to which testing can be combined with experimentation will be explored in JEFX 06. As part of the TBMCS 1.1.4 upgrade, the AOC will undergo Developmental Test and Evaluation during the spiral events and Operational Test and Evaluation during main execution. The requirements of the test community will force management to segregate experimentation activities in time and/or space to eliminate experimentation variables from the testing environment. This new way of doing business brings the acquisition community in early to develop test and support plans. This change should improve the transition of successful initiatives after the experiment.

Summary

The management of a large-scale C2 experiment such as JEFX continues to evolve, based on both internal lessons learned and lessons learned from other experiments and reports. The lessons on design, planning, and assessment of JEFX have been captured for all five JEFX experiments beginning in 1998. The JEFX experimentation management lessons documented here contribute to the larger body of knowledge on experimentation.

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